## Claims:

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We claim:

1. A method of sizing cracks in a metal surface using sound wave measurements of propagation and reflection thereof which are initiated at an optimal degree angle to the surface comprising the steps of:

review sound wave data for signal reflections at I/2 skip, full skip and 1 I/2 skip locations;

when I/2 skip, full skip and 1 I/2 skip reflections are detected reviewing reflected signals for a crack tip signal;

whenever crack tip signal is verified using crack tip signal to size the surface crack.

2. A method as set forth in claim 1 including the further steps of:

reviewing reflected signal data to determine if no crack tip signal was detected and that reflections are present at the I/2 and I I/2 skip locations;

using target motion TOF with MCS correction to size the surface crack.

- 3. A method as set forth in claim 2 including the further steps of:
- reviewing signal reflected data to determine if full skip signal was present in addition to the I/2 skip and I I/2 skip signals;

using FSN sizing method to size the surface crack whenever the above signals are present.

- 4. An FSN method where the ratio of the full skip amplitude to the average of the outer diameter skip amplitudes produces a normalized result. This ratio can be used to depth size deep cracks propagating from the surface opposite from the UT transducer.
- 5. A method as set forth in claim 4 where the FSN ratio is converted to the remaining wall thickness with a convenient formula.
- 6. A method as set forth in claim 5 where for the given application of the thin wall tubing with thickness between 0.035 to 0.070 inches, the remaining wall thickness is obtained by the following formula:

Remaining Wall (inches) = 0.031 - FSN ratio \* 0.031

7. A method as set forth in claim 3 wherein the sound waves are UT waves initiated at an appropriate angle to the metal surface.

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8. A method as set forth in claim 7 wherein the metal surface is a composite or otherwise intimately bonded layer of metal tube or plate having a crack width less than 0.001 in.

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9. A mode conversion method (MCS) as set forth in claim 2 where the **UNCORRECTED UT DEPTH ESTIMATE** is the UT system depth measurement based on the conventional shear wave target motion time of flight (TOF) analysis.

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10. A mode conversion method (MCS) as set forth in claim 2 where the **UNCORRECTED TOF DEPTH PREDICTION** is derived from a theoretical model of a mode converted signal. The model calculates the resultant of depth based on the known notch depth and shear wave target motion TOF technique.

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11. A mode conversion method (MCS) as set forth in claim 2 where the **CORRECTED TOF DEPTH PREDICTION** is the **UNCORRECTED UT DEPTH ESTIMATE** value multiplied by a MCS correction factor.

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12. A method as set forth in claim 2 wherein the metal surface is a thin wall tube and the MCS correction factor is determined experimentally and is between 1.6 and 1.9.

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